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# HOUSE PRICE DYNAMICS IN MUMBAI, 1989-1995

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The objective of this paper is to study the importance of price index methodology to analyzing intra-metropolitan house price variations in Mumbai. Two hedonic regression-based approaches — cross section and explicit time variable — are compared. The results indicate conclusively that the former is better than the latter. This paper also contributes to the literature on intra-metropolitan house price variations by explaining them based on urban development, population and employment patterns in Mumbai.

## 1. Introduction

Mumbai is one of the world's most expensive cities. A habitat for around 14 million people, according to 1991 Census, and hub of financial and trade activities in India, Mumbai has witnessed unprecedented appreciation in house prices during the early nineties. Institutional structure has had a very strong influence on house price movements. Land markets do not exist in a real sense and a plethora of regulations governs the supply of land. Laws enacted during World War II, e.g. for rent control, still exist. The impact of rent control, like under-maintenance of rental housing and a nearly non-existent new rental housing market, is quite evident. One of the main sources of revenue for local governments is property taxation, which is linked to "assessed value" of the house. The assessed value in many old houses is a mere upward revision of the frozen 1942 rent level (due to the rent control law enacted in 1942). However, these assessed values are far below market values. The demand structure for housing in Mumbai is such that no house filters out of the market, despite being dilapidated (Tiwari, 1996). This is the manifestation of an inelastic supply response and rigid regulations governing housing markets. According to MMRDA (1997), most new house construction is in locations far away from the Central Business District (CBD). The result is that most new homeowners located far away from the CBD pay much higher property tax than those living in old houses located in the CBD, in real terms, because the assessed value for newer houses is higher than that of older houses.

Mumbai has a bell shaped topography. Its business district is located on the southern tip of a peninsula. The topography


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of the city has restricted dramatically the supply of land and influenced house prices and the pattern of house price movement. There is no systematic house price index to analyze the pattern of house price movements in the city.

In the literature, numerous studies have developed aggregate constant quality house price indices at the national, regional, or city level (Abraham and Schauman, 1991; Haurin et al., 1991; Hosios and Pesando, 1991; Peek and Wilcox, 1991; Case and Schiller, 1987; Englund et al., 1996; Wigren, 1987; Tiwari and Turner, 1998). These indices explain household formation, housing demand and migration in order to evaluate the effects of local policies and events, and to examine housing market efficiency (Abraham and Hendershott, 1996; Gyourko and Voith, 1992; Case and Schiller, 1989; Guntermann and Smith, 1987; Hort, 1997; and Berg, 1997).

Despite its importance, little is known about the variability of house price changes within a city or a metropolitan market. In an earlier article, Munro and McLennan (1987) explain the importance of intra-urban analysis of house prices. Their study on Glasgow indicates a pattern different than that of national price movements. Despite being an economically declining city, Glasgow witnessed growth in house prices much higher than the national average during the period 1972-1983 because of various regional factors. Since then, very few articles have been written on local house price movements (for example, Tiwari and Turner, 1998; Archer et al., 1996; Gatzlaff et al., 1994). The reason has been lack of attention accorded to developing intra-metropolitan house price indices. Three other issues not addressed adequately in the earlier research are:

- the underlying house price index methodology itself;
- the construction of an index within a metropolitan area, and
- the use of intra-metropolitan price indices to explain price variability within a metropolitan region.

A casual observation would clearly indicate that the level of house prices varies significantly within a metropolitan area. Moreover, according to the classical model of urban rent in Muth-Mills tradition, the rate of house price appreciation should not be uniform across submarkets within a metropolitan area (e.g. deLeeuw and Struyk (1975), Muth (1975), and Rose-Ackerman (1975)). However, with few exceptions (e.g. Rachlis and Yezer (1985), Case and Shiller (1989), Case and Mayer (1995), Munro and Mclennan (1987)), the existence of appreciation variation within a metropolitan area has not been formally documented.

The purpose of this paper is to develop housing price indices for Mumbai and examine variations in the rate of house price appreciation within the city during 1988-1995. Specifically, the paper aims to 1) critically examine methodology of price indices; 2) develop a price index for the Mumbai metropolitan region; and 3) analyze price variability within the Mumbai metropolitan region and explain price growth in different zones. Section 2 reviews various house price index models. Section 3 introduces the data. Section 4 presents and discusses the empirical results, with Section 5 offering concluding remarks.

## 2. Conceptual Framework

House price indices are typically modelled using either the hedonic approach, the repeat-sale method or the hybrid method, which combines the hedonic and repeat sale techniques. Hedonic multivariate regression is a technique for measuring price while

controlling for the quality of the heterogeneous commodities. The underlying rationale is that housing can be thought of as a bundle of separately measurable characteristics. The hedonic index application requires a sample of house sales from multiple time periods (or multiple locations). Transaction prices are regressed on structural and locational characteristics. The vector of coefficients estimates the implied marginal contribution of each characteristic, relative to the composite price. Applying the implicit prices for each period to a standardized bundle of house characteristics yields an index of prices for the bundle. The index represents an estimate of the price that would have occurred if no variability existed in the included characteristics.

The repeat-sales technique has been rediscovered as a means of avoiding many of the problems associated with hedonic models (Case and Shiller, 1994; Palmquist, 1980). The repeat sales model is the difference in the log of a "second" sale model to the log of "first" sale model. The primary justification for use of the repeat sales model is that it avoids some of the problems related to controlling for housing quality that are associated with standard hedonic models. If housing quality is constant between transactions, the difference between transaction prices at two dates is a function solely of the intervening time period. If the constant-quality condition holds, the data requirements are significantly reduced; only the two sale prices and dates of sale are required for an index construction.

However, the constant quality assumption is very strong. A combined hybrid index, which combines the advantages of the hedonic and repeat-sale models, has been well established (Case and Quigley, 1995: Case, Pollakowski, and Wachter, 1991: Quigley, 1995; Englund, and Quigley and Redfearn, 1996).

Meese and Wallace (1997) compare various house price indices (hedonic, repeat sales and hybrid) for the cities of Oakland and Fremont during 1970-1988. They, however, do not find a definitive superiority of hybrid indices over others. In fact, they conclude by saying "we recommend that researchers interested in questions of housing market efficiency rely on hedonic indices (at least at the municipality level)."

Since no one methodology has been established as conclusively superior to others, we use hedonic regressions. Once the hedonic equation has been estimated econometrically, it is used to develop a price index. There are two major model types: explicit-time-variable and strictly-cross-section. The former pools all the data for the adjacent time periods and includes time as an independent (dummy) variable. The following is a popular functional form (e.g. Clapp and Giaccotto (1991)):

$$ln\,Pit = \sum_{j=1}^{k} \beta j\, ln\, Xjit + \sum_{t=1}^{T} \beta t Dit + \varepsilon it, \quad (1)$$

where $Pit$ is the transaction price of property $i$ ($i = 1...n$) at time $t$ (t = 1...$T$), $\beta j$ ($j = 1...k$) are a vector of coefficients on the structural and locational attributes, $Xjit$; $\beta t$ ($t = 1...T$) are a vector of time coefficients of time dummies $Dit$ (with value of 1 if the $i$th house is sold in period $t$, 0 otherwise); and $\varepsilon it$ is the random error with mean 0, and variance $\sigma 2$. The regression coefficients on the time variables represent the logarithm of the cumulative price index. The explicit time-variable approach risks encountering non-stationary implicit prices because data are aggregated across time periods.

In a strictly cross-sectional model of house prices, the implicit characteristic prices are estimated in a separate hedonic regression for each time period, thereby allowing the implicit attribute prices to vary

over time. Conventional price indices are then calculated for each period by applying the estimated implicit prices for each time period to a standardized bundle of housing attributes. The data requirement of a cross-sectional model is very large, particularly while constructing a quarterly series.

The literature mentions three types of constant quality house price indices (Thibodeau; 1996): the Laspeyres index, which measures the price change that occurred in the beginning period's bundle of housing characteristics; the Paasche index, which measures the price change that occurs in the ending period's bundle; and the Fisher index, which is the geometric mean of the Laspeyres and Paasche indices. We compute all three to see how they move relative to each other and which of them is likely to be the best choice.

## 3. Data

The data used in this paper to develop house price indices for Mumbai were drawn from the largest house mortgage-company in India, for the period 1989-1995. The data (and the index) are for owner-occupied houses (OOH) only. The database has a fairly wide geographic coverage of houses and household distribution.

There are certain issues that need to be addressed before developing the indices. Many regulations concerning house purchase — the stamp duty (a one-time fee charged by the local government for the registration of home ownership), property tax and capital gains — influence the sale value of the house for households as well as landlords. Both households and landlords therefore have incentive to under-report house prices to avoid taxes. A significant part of the transactions is in cash and is not reported in the "agreement value" (registered with the stamp office in the sales document as the value of the house). This is a persistent problem with the database. Borrowers' files (including those used for this paper) do not detail the portion paid in cash; hence the agreement value under-reports the house value. Housing mortgage companies lend only based on agreement value (Tiwari, 1997). Further, mortgage financing in India is not more than 30-50% of the market value of the house.

Related to the above, since agreement value is different from actual value, many high value houses are sold with no financing; household savings provide the large cash element, with no financial incentive for such households to borrow. Further, information about house characteristics is limited to the following: area in square feet; status of construction (new, under-construction or old house); type of mortgage (complete mortgage with one company, second mortgage, or no mortgage); type of building (single family or multi-family); and location.[1] We have built a few variables related to location, such as distance of the house from the CBD and status of the area (high or low, with high indicating that the location is preferred by the upper income segment).

In the absence of information about cash paid by households to landlords or builders, we estimate an instrument variable for the cash component using information collected about the perception of real estate brokers on the price-per-unit area of houses in various locations in Mumbai during 1989-95. We use the following model:

$$Cash = 1 - \frac{Cost}{AVALUE} = f(zone, time) \quad (2)$$

[1] In the most common type of mortgage, the house is completely mortgaged with the company. Our data indicate that this type accounts for 99.8% of the sample. The other mortgage types were the exception. Type of mortgage variable dropped out of our regression as insignificant.

where:
*Cash* = percentage amount of value of house paid in cash;
*Cost* = agreement value in rupees per square foot of house area, taken from borrower's files;
*zone* = dummy for different zones;
*time* = time dummies for different years;
*Avalue* = zonal average house price per square foot of house area, taken from broker information.

We estimate the above model for all houses mortgaged and form a matrix of predictors for the percentage of house value estimated as paid in cash for different years in different zones. To get the estimated actual value of the house, we inflate the agreement value of the house by these percentages. This method may lead to underestimation and over-estimation for some houses. However, the sample is very large, so there is reasonable expectation that the final index is a reasonable approximate of the actual market house price index.

Zonal definition is also very important. We sub-divide Mumbai into the following zones based on the price per square foot in the area. Below is the most commonly used zonal subdivision in Mumbai; the development of prices within a zone is similar.

Zone 1: South Mumbai (Colaba-Grant Road-Kalbadevi)
Zone 2: Central Mumbai (Bombay Central-Dadar-Bandra-Byculla-Parel-Wadala-Sion-Kurla)
Zone 3: Western Suburbs (Khar Road-Borivili)
Zone 4: Central Suburbs (Chembur-Thane)
Zone 5: Extended Western Suburbs (Beyond Borivili)
Zone 6: Extended Eastern Suburbs (Beyond Thane)
Zone 7: New Mumbai

Table 1 shows the estimated function for equation 2. Based on the table, the proportion of house value paid in cash is shown in Table 2. The average housing characteristics (structural and locational) used in the hedonic price model for 1989 and 1995 are shown in Table 3.

The mean values of house characteristics indicate that the area of houses sold during the period under investigation increased by around 80 square feet between 1989 and 1995. The number of home sales indicates that during the year 1995 the proportion of houses sold increased by more than 8% in extended western suburbs and by around 4% in New Mumbai, but decreased in extended eastern suburbs by around 3%. This is due to escalating property prices, which have driven households away from Mumbai Island to suburbs. There has been a change in the distribution of houses sold in each quarter from 1989 to 1995. During 1989, most transactions took place during the fourth quarter. During 1995, transactions were evenly distributed over the four quarters. The housing market also showed vibrant trends; many old houses were put up for sale in 1995; around 12% of houses were re-sales compared to 0.2% in 1989.

## 4. Results and Discussion

There are three questions to be analyzed, as follows:

- Are there any significant differences in price indices due to the choice of hedonic approach i.e., explicit-time-variable versus strictly-cross-section?
- Are there any significant differences in price indices based on different formulations of indices (i.e., Laspeyres, Paasche and Fisher)?
- Are there differences in house price appreciation in different zones? If so, why?

**Table 1. Predictor for Cash Proportion in House Transactions**
Dependent Variable = Cash

| Variable | Estimate | T-value |
|---|---|---|
| Dummy for Zone1; Yes=1, No=0 | 0.112 | 5.61 |
| Dummy for Zone2; Yes=1, No=0 | 0.0743 | 5.94 |
| Dummy for Zone3; Yes=1, No=0 | 0.0427 | 6.25 |
| Dummy for Zone4; Yes=1, No=0 | 0.0208 | 3.02 |
| Dummy for Zone5; Yes=1, No=0 | -0.183 | -27.21 |
| Dummy for Zone6; Yes=1, No=0 | -0.178 | -25.21 |
| Dummy for Year 1990; Yes=1, No=0 | -0.011 | -2.17 |
| Dummy for Year 1991; Yes=1, No=0 | 0.0064 | 1.28 |
| Dummy for Year 1992; Yes=1, No=0 | -0.036 | -6.77 |
| Dummy for Year 1993; Yes=1, No=0 | -0.0334 | -6.15 |
| Dummy for Year 1994; Yes=1, No=0 | 0.10499 | 19.08 |
| Dummy for Year 1995; Yes=1, No=0 | 0.0985 | 18.03 |
| Constant | 0.455 | 58.7 |
| R-squared | 0.29 | |
| Number of observations | 26017 | |

**Table 2. Estimated Proportion of House Value Paid in Cash**

| | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 |
|---|---|---|---|---|---|---|---|
| 1989 | 0.56 | 0.52 | 0.49 | 0.47 | 0.27 | 0.27 | 0.45 |
| 1990 | 0.55 | 0.51 | 0.48 | 0.46 | 0.26 | 0.26 | 0.44 |
| 1991 | 0.57 | 0.53 | 0.50 | 0.48 | 0.28 | 0.28 | 0.46 |
| 1992 | 0.52 | 0.48 | 0.45 | 0.43 | 0.23 | 0.23 | 0.41 |
| 1993 | 0.53 | 0.49 | 0.46 | 0.44 | 0.24 | 0.24 | 0.42 |
| 1994 | 0.66 | 0.62 | 0.59 | 0.57 | 0.37 | 0.37 | 0.55 |
| 1995 | 0.65 | 0.61 | 0.58 | 0.56 | 0.36 | 0.36 | 0.54 |

The estimated hedonic price function with explicit time dummies and strictly cross-sectional functions is tabulated in Table 4.

The first question is regarding the appropriateness of methodology i.e., which of the two hedonic price methodologies should be used. For Mumbai, we find that the results are quite different. The implicit prices of variables in the model have changed over time, as shown in Table 4. Chow's test (1960) for stability of estimated characteristic coefficient across years indicates that the hypothesis that the estimated characteristic coefficient for one year equals that for the other year is rejected. For Mumbai, therefore, we use strictly cross-section regression equations to calculate the house price index.

The next question is regarding the choice of index. Figure 1 plots the Laspeyre,

**Table 3. Mean and Standard Deviation of House Characteristics**

| Characteristics | Mean 1989 | Standard Dev. 1989 | Mean 1995 | Standard Dev. 1995 |
|---|---|---|---|---|
| Area (square meter) | 50.73 | 29.098 | 58.9 | 90.52 |
| Distance (km) | 50.57 | 23.005 | 47.31 | 16.97 |
| Dummy for single family; 1=Yes, 0=No | 0.014 | 0.118 | 0.0013 | 0.0356 |
| Dummy 1=on west side of railway line; 0=on east side of railway line | 0.458 | 0.498 | 0.457 | 0.498 |
| Dummy for Zone 1; 1=Yes, 0=No | 0.0033 | 0.057 | 0.00805 | 0.089 |
| Dummy for Zone 2; 1=Yes, 0=No | 0.0092 | 0.096 | 0.01289 | 0.112 |
| Dummy for Zone 3; 1=Yes, 0=No | 0.182 | 0.386 | 0.1849 | 0.388 |
| Dummy for Zone 4; 1=Yes, 0=No | 0.251 | 0.433 | 0.1878 | 0.391 |
| Dummy for Zone 5; 1=Yes, 0=No | 0.272 | 0.445 | 0.3531 | 0.478 |
| Dummy for Zone 6; 1=Yes, 0=No | 0.283 | 0.51 | 0.253 | 0.48 |
| Dummy for Zone 7; 1=Yes, 0=No | 0.015 | 0.120 | 0.0564 | 0.231 |
| Dummy for properties under construction | 0.966 | 0.179 | 0.853 | 0.354 |
| Dummy for old | 0.00216 | 0.05 | 0.117 | 0.322 |
| Dummy for quarter 1; 1=Yes, 0=No | 0.032 | 0.176 | 0.279 | 0.449 |
| Dummy for quarter 2; 1=Yes, 0=No | 0.157 | 0.364 | 0.287 | 0.453 |
| Dummy for quarter 3; 1=Yes, 0=No | 0.313 | 0.464 | 0.219 | 0.414 |
| Dummy for quarter 4; 1=Yes, 0=No | 0.498 | 0.5 | 0.215 | 0.48 |

Paasche and Fisher indices for Mumbai as a whole, and shows clearly that choice of index is very important. There is a substantial difference between the Laspeyre and Paasche indices primarily because the bundle of house characteristic has undergone change over time. This raises an important question: Should the index use base parameters (i.e. Laspeyre's type) or end period parameters (i.e. the Paasche type) or a combination of the two? There is no theoretical argument in favor of using either Laspeyre or Paasche. Another index, the Fisher index, which is a geometric mean of the Laspeyer and Paasche indices combines the features of both base as well as end weights. It is used in the remaining discussion.

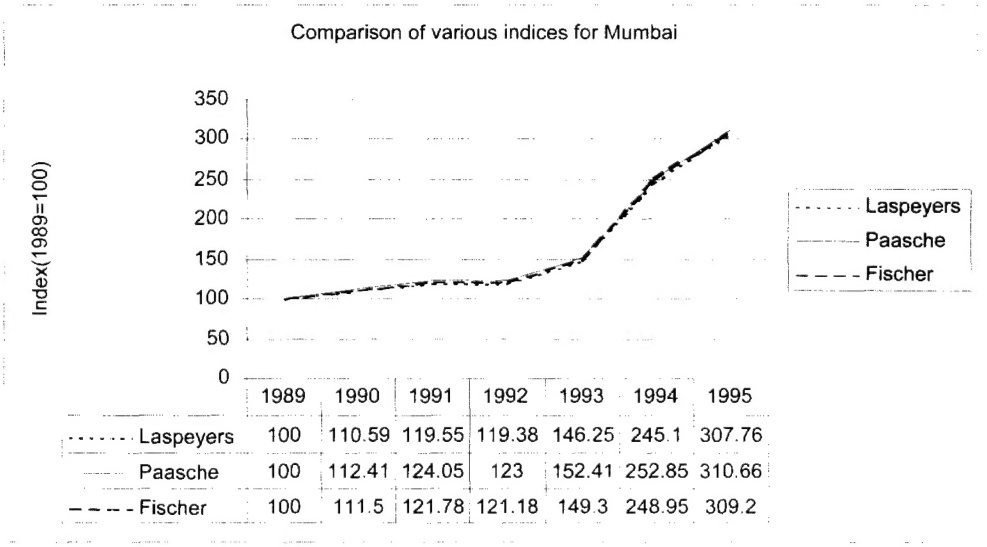
Figures 2 and 3 show the quarterly index for various zones in Mumbai. The indices indicate stable growth in prices until 1991, followed by decline and then again unprecedented appreciation. The reasons for this pattern can be traced to developments in the Indian economy, which in 1991 underwent a crisis both on external as well as internal macroeconomic accounts. This was also the time when stock markets boomed to unprecedented levels, then crashed following a scam. The impact was seen in all markets, including housing. Following 1991, India adopted an economic liberalization policy and opened the economy to foreign investment. Mumbai, being the financial capital of India, attracted much of it. This also raised the expectations of real estate investors for future expected capital gains. Stock markets were still recovering from earlier shocks.

**Table 4. Hedonic Price Function for Mumbai**

Dependent Variable = Log (House Value in Rupees)

| Variables (Dummies: Yes=1, No=0) | Explicit Time Dummies | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|---|
| Log (area of house in square feet) | 0.93901 (208.2) | 0.88536 (62.64) | 0.97938 (116.8) | 0.89817 (132.6) | 0.96124 (95.2) | 1.0851 (93.0) | 0.9756 (64.2) | 0.8981 (77.9) |
| Log (distance from CBD in km) | -0.65657 (-72.09) | -0.55269 (-24.05) | -0.46556 (-31.03) | -0.58637 (-40.6) | -0.56848 (-28.9) | -0.8087 (-32.1) | -1.026 (-33.4) | -0.8537 (-28.8) |
| Dummy for single family houses | -0.16752 (-7.967) | -0.10288 (-2.5) | -0.25585 (-8.26) | -0.30379 (-11.7) | -0.20441 (-4.73) | 0.0017 (0.02) | -0.0304 (-0.21) | 0.07395 (0.51) |
| Dummy for east-west; if west=1, otherwise, 0. | 0.12869 (36.86) | 0.11601 (11.11) | 0.11454 (19.85) | 0.11844 (21.9) | 0.13047 (18.3) | 0.176 (19.5) | 0.261 (22.3) | 0.19582 (17.8) |
| Dummy for Zone 1 | 0.61022 (14.63) | 0.22032 (1.9) | 1.0135 (13.71) | 0.64235 (9.53) | 0.93798 (10.1) | 0.097 (0.9) | -0.1448 (-1.06) | 0.33698 (2.73) |
| Dummy for Zone 2 | 0.79894 (37.50) | 0.70532 (11.75) | 0.78058 (23.45) | 0.77087 (24.2) | 0.89447 (20.3) | 0.79 (13.5) | 0.6225 (7.92) | 1.0135 (14.9) |
| Dummy for Zone 3 | 0.75530 (89.10) | 0.64954 (27.32) | 0.73135 (52.85) | 0.64899 (48.8) | 0.67731 (38.8) | 0.753 (34.7) | 1.0163 (34.3) | 1.1280 (40.5) |
| Dummy for Zone4 | 0.51865 (65.40) | 0.36636 (17.22) | 0.38053 (29.99) | 0.43063 (35.0) | 0.44183 (26.4) | 0.536 (25.9) | 0.9478 (34.1) | 0.71595 (27.9) |
| Dummy for Zone 5 | 0.13256 (25.93) | 0.13565 (9.8) | 0.09709 (12.97) | 0.11943 (15.4) | 0.15378 (13.9) | 0.219 (13.95) | 0.2492 (12.11) | 0.18803 (12.4) |
| Dummy for Zone 7 | 0.68965 (69.03) | 0.52376 (13.75) | 0.48682 (26.94) | 0.67706 (50.4) | 0.68245 (26.2) | 0.819 (27.1) | 0.9856 (28.1) | 0.9756 (38.3) |
| Dummy for properties under construction | 0.10242 (9.037 | 0.06595 (2.34) | 0.09071 (4.04) | 0.05504 (4.7) | 0.15992 (4.47) | 0.284 (4.7) | 0.0204 (0.25) | 0.14265 (4.35) |
| Dummy for old houses | 0.21311 (16.37) | 0.08436 (0.85) | 0.20525 (3.97) | 0.18214 (4.46) | 0.248 (6.03) | 0.375 (6.16) | 0.0631 (0.78) | 0.16813 (4.66) |
| Dummy for quarter 1 | -0.047 (-9.80) | -0.02147 (-0.84) | -0.03781 (-4.96) | -0.0199 (-2.7) | -0.0508 (-5.18) | -0.0412 (-3.3) | -0.0273 (-1.7) | -0.090 (-5.9) |
| Dummy for quarter 2 | -0.030 (-6.47) | -0.11566 (-7.35) | -0.05012 (-6.96) | 0.0006 (-0.08) | -0.00477 (-0.47) | -0.0476 (-4.04) | -0.0026 (-0.2) | -0.0823 (-5.5) |
| Dummy for quarter 3 | -0.007 (-1.41) | 0.00728 (0.72) | -0.00589 (-0.83) | -0.0033 (-0.44) | -0.01724 (-1.73) | -0.0095 (-0.8) | 0.0182 (1.12) | -0.031 (-1.93) |
| Dummy for 1990 | 0.089197 (12.46) | | | | | | | |
| Dummy for 1991 | 0.18299 (25.56) | | | | | | | |
| Dummy for 1992 | 0.16079 (21.08) | | | | | | | |
| Dummy for 1993 | 0.40869 (51.55) | | | | | | | |
| Dummy for 1994 | 0.99063 (124.0) | | | | | | | |
| Dummy for 1995 | 1.1093 (141.2) | | | | | | | |
| Constant | 10.82 | 10.740 | 10.107 | 10.979 | 10.544 | 10.99 | 12.875 | 12.662 |
| R-squared | 0.9076 | 0.91 | 0.91 | 0.92 | 0.91 | 0.89 | 0.89 | 0.91 |

**Figure 1**




| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|
| Laspeyers | 100 | 110.59 | 119.55 | 119.38 | 146.25 | 245.1 | 307.76 |
| Paasche | 100 | 112.41 | 124.05 | 123 | 152.41 | 252.85 | 310.66 |
| Fischer | 100 | 111.5 | 121.78 | 121.18 | 149.3 | 248.95 | 309.2 |

**Figure 2**

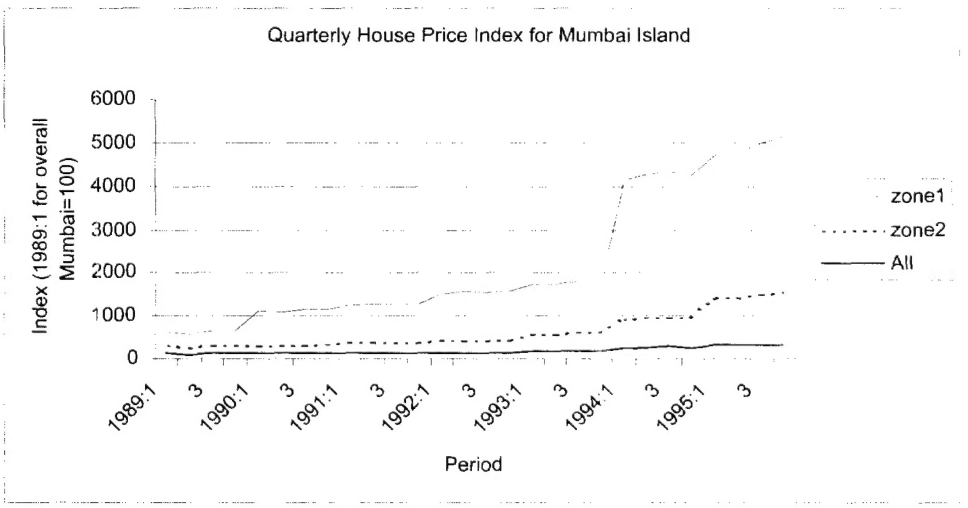
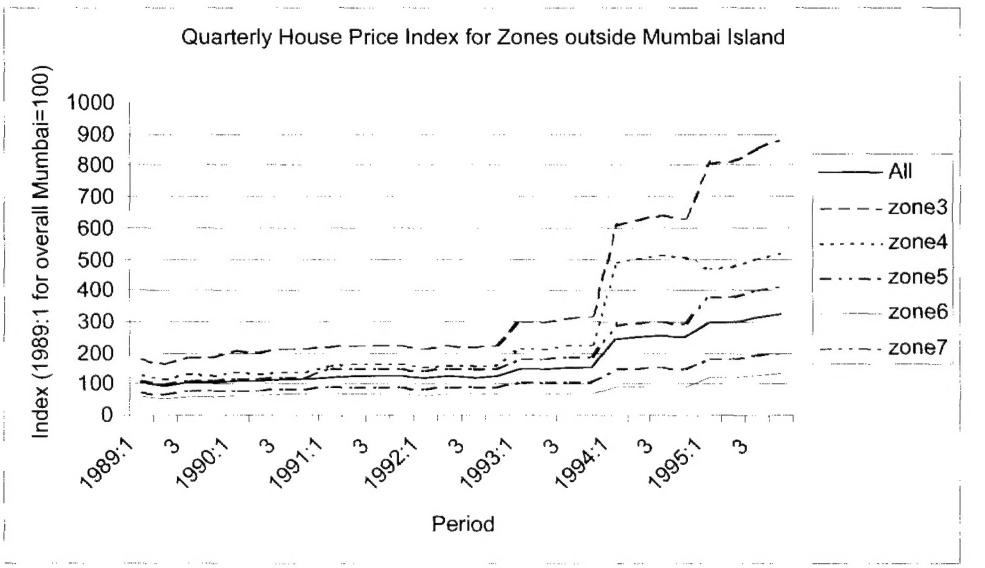


**Figure 3**




Combined demand of increased investment and consistent growth of property markets increased real estate investment demand. With the housing market fuelled, Mumbai saw uncontrolled growth in prices.

We disaggregate our analysis further to look at the process of house price development within the local housing market. An obvious question that must be addressed in is whether all owners in Mumbai have gained equally from house price appreciation. Figures 2 and 3 are the Fischer type quarterly house price indices for various zones in the city.

If there are great differences in potential for capital accumulation within the owner occupied market, there are then profound implications for cohesion of housing classes based on owner occupation as tenure. Our data indicate that capital accumulation varied widely within the period. We examine these variations and then return to the housing class controversy to draw out some implications. The house price indices for various zones in Mumbai follow more or less similar trends, however; there are huge differences in absolute magnitude.

The house price appreciation in the zones varies significantly. Figures 2 and 3 indicate that the highest appreciation has been in Zone 1, followed by Zones 2, 3, 4, 7, 5 and 6, in that order. In order to examine this more systematically, we calculate a rank correlation of the areas in price order between 1989 and 1995, and a second correlation between initial position in the hierarchy and overall price appreciation during the same years. The Spearman coefficient between position of zones in 1989 and 1995 is 1.0 and is significant at the 99% level. This confirms that zones stay within the same rank order. The Spearman correlation coefficient is positive with value 1.0 between initial position of zones and price appreciation up to 1995, indicating that the appreciations are also in same order.

During 1989-1995, prices appreciated by 700% in Zone 1. During the same period, appreciation in Zone 2 was around 450%. Zones 3 and 4 appreciated by 325 and 300%, respectively. The appreciation in Zones 5 and 6 was by 250 and 200%. Zone 7 appreciated by 400%.

The explanation for differences in price developments in various zones can be found in the topography of Mumbai and various institutional policies concerning its land use. The city's bell-shaped topography is surrounded on three sides by sea, with a narrow strip of land (around 15km long and 1-5 km wide) that expands into the mainland. Historically, the tip of this narrow strip (Zone 1) developed as the industrial and trade center because of its locational advantages. Most jobs are located in this region. The planning doctrine of the 1970s ("decongesting the city") was enshrined in public policies concerning the development of Mumbai. The growth of this and adjacent areas (Zone 2) was prohibited through development control regulations, the most important being floor area restriction (FAR). Mumbai Island (Zones 1 and 2) has a FAR of 1.33, the suburbs (Zones 3 and 4) have a FAR of 1.0. During the 1980s, many textile mills in Zone 2 closed down. For the last two decades, no effective policy concerning this huge mass of land has evolved; most of the land is lying economically unused. The lack of land supply and enforced FAR resulted in expansion of the city, or urban sprawl, as shown in Table 5.

Table 5 indicates that most of the development has occurred in Thane or Kalyan or New Mumbai, or in areas very far from the CBD. No new built-up space has been created in more than two decades in the CBD or the Island City, where the demand exists. The implication of this restrictive growth is seen in prices.

One consequence of the regulations concerning land has been that the center of gravity of population and employment do not coincide. Table 6 indicates clearly that until 1951 more than 75% of Mumbai's population was concentrated in the city (Mumbai Island). After, the proportion of population living on Mumbai Island did not grow and indeed declined to around 30% of total city population. Most of the population growth was concentrated in the suburbs. Table 7 indicates that the proportion of jobs concentrated in the city was around 64% in 1980. This contrasts with the proportion of population living in city in 1981, which was 40% of the total. With too much competition for too few goods in the city, house prices continued escalating at a much higher pace than in the suburbs. This phenomenon was further intensified by the fact that due to very high property prices, commercial establishments also started moving out of the city, closer to their employees. In 1990, the suburbs accounted for 45% of jobs, compared to 36% in 1980.

An important anomaly of differentials in property price appreciation has been in terms of capital gains potential and property taxation. Table 8 presents historical accounts of property tax revenue of the Municipal Corporation of Greater Mumbai (MCGB). The MCGB collects property tax from the city (Zones 1 and 2) and suburbs (Zones 3 and 4). The appreciation in property tax has not been proportional to appreciation in house prices, indicating that households in Zones 1 and 2 gain both through price appreciation and underpayment of property tax compared to those in Zones 3 and 4, who would be in a better position than those in Zones 5 and 6. Zone 7 has a very different institutional structure, as it was developed by the government as an alternative nodal for Mumbai (decongestion philosophy) and is mostly newly built (less than 25 years old) by a government institution called the City and Industrial Development Organization (CIDCO).

**Table 5. Urban Sprawl in Mumbai (Built-up Area in km$^2$)**

| | 1968 | 1983 | 1987 | Annual Growth 1968-83 (%) | Annual Growth 1983-87 (%) |
|---|---|---|---|---|---|
| 1. Greater Mumbai | 219.16 | 255.01 | 301.29 | 0.6 | 4.3 |
| a) CBD (Zone1) | 23.13 | 23.13 | 23.13 | Nil | Nil |
| b) Island city (Zone 2) | 53.48 | 53.48 | 53.48 | Nil | Nil |
| c) Eastern suburbs (Zone 4) | 64.8 | 78.75 | 95.43 | 1.3 | 4.5 |
| d) Western Suburbs (Zone 3) | 78.75 | 99.65 | 129.25 | 1.6 | 6.7 |
| 2. Thane M.C. (Excluding Thane city: Zone 5 and 6) | 0.36 | 1.48 | 48.11 | 9.7 | 138.8 |
| 3. Kalyan M.C.(Zone 6) | 1.54 | 25.39 | 74.43 | 20.5 | 30.8 |
| New Mumbai (Zone 7) | 4.6 | 15.7 | 75.9 | 8.5 | 48.3 |
| Rest of MMR (Zone 5 and 6) | 8.43 | 20.37 | 75.75 | 6.05 | 38.7 |
| Total | 234.09 | 317.95 | 575.48 | 2.0 | 15.6 |

Source: MMRDA (1997)

**Table 6. Percentage Distribution of Population Growth in Mumbai**

| Year | City | Suburbs | Extended Suburbs |
|---|---|---|---|
| 1901 | 83.6 | 7.7 | 8.67 |
| 1921 | 85.18 | 8.57 | 6.25 |
| | (84.8) | (15.62) | (-0.42) |
| 1951 | 77.78 | 17.04 | 5.18 |
| | (70.3) | (25.56) | (4.11) |
| 1981 | 39.85 | 42.73 | 17.42 |
| | (9.44) | (59.65) | (30.91) |
| 1991 | 31.99 | 41.91 | 26.03 |
| | (-6.6) | (38.35) | (68.2) |

Figures in bracket indicate percent share in increment.
Source: MMRDA (1997)

**Table 7. Spatial Distribution of Employment in Greater Mumbai**

| | 1980 | 1990 |
|---|---|---|
| City | 63.62% | 55.62% |
| Suburbs | 36.38% | 44.38% |
| Total (numbers) | 352468 | 628817 |

Source: Economic Census 1980 and 1990.

**Table 8. Property Tax of Municipal Corporations in Greater Mumbai, 1980-1991**

| | 80-81 | 81-82 | 82-83 | 83-84 | 84-85 | 85-86 | 86-87 | 87-88 | 88-89 | 89-90 | 90-91 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tax at constant price (crores) | 59.6 | 62.1 | 60.1 | 63.6 | 66.3 | 66.7 | 69.9 | 76.6 | 77.7 | 78.6 | 75.0 |
| Number of properties (thousands) | | | | | | | | | | | |
| City | 61.6 | 64.6 | 61.5 | 61.6 | 62.0 | 62.2 | 62.5 | 62.8 | 63.0 | | 61.8 |
| Suburb | 136.4 | 145.4 | 153.1 | 218.4 | 222.4 | 162.5 | 164.8 | 167.3 | 170.1 | | 233.0 |
| Rateable value (crores) | | | | | | | | | | | |
| City | 76.2 | 82.4 | 85.7 | 88.7 | 92.9 | 97.0 | 100.3 | 107.5 | 124.8 | 133.3 | 141.8 |
| Suburbs | 65.0 | 76.8 | 83.4 | 89.7 | 97.3 | 107.1 | 120.8 | 136.3 | 160.1 | 179.9 | 199.7 |

It has been possible to reflect the actual price of property in taxation for New Mumbai (Zone 7).

The above raises an important question about the rationality of many laws concerning housing market and taxation policy. For a more in-depth understanding, however we must investigate further the socio-economic status of people living in the different zones. It may be that most dwellers of older areas (Zones 1, 2) have been there for a long time and are middle income earners who have not capitalized on the opportunity for capital gains. In that case, the notion of advantage is rather vague.

## 5. Conclusion

This is the first initiative to develop house price indices for owned houses in any city in India. A comparison of the hedonic model with explicit time dummy and the cross-sectional hedonic model indicate superiority of the latter for Mumbai. The choice of period for bundling housing characteristics is very important. The indices with a base period bundle (Laspeyre) differ significantly from those with an end period bundle (Paasche). In the case of Mumbai, the authors recommend the use of the Fisher-type index, which is a geometric mean of the Laspyere and Paasche indices.

The indices indicate that prices grew at fairly stable rates during 1989-1991, after which there was some decline, followed by unprecedented appreciation. The reason for such fluctuation can be found in the macro-economic developments of the Indian economy as well as deregulation policies.

An analysis of price patterns for different zones in Mumbai indicates that there are considerable differences in price development and appreciation among them. Future research should concentrate on evaluating the impact of land regulations on house prices and of capital gains differentials on social cohesion.

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